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Innovation Performance and Technical Innovation of Chinese Textile and Clothing Enterprises

Qingfen Zhang, Yuwen Zheng

School of Management, Xi'an Polytechnic University, Xi'an 710000, China

Abstract: In recent years, as the cycle of changing consumer demand has become shorter and shorter as well as the gradual disappearance of China's demographic dividend, it has led to more difficulties in the development of China's textile and clothing industry. Technological innovation is the power source of enterprise growth. Firstly, this paper analyses the basic situation of China's textile and clothing industry using panel data of A-share listed companies in the textile and garment industry in Shanghai and Shenzhen from 2005 to 2019. Secondly, the empirical study concludes that technological diversification positively affects corporate innovation performance; finally, suggestions are made to address the issues that need to be improved and addressed in China's textile and apparel industry.

Keywords: Technological Innovation; Innovation performance; Textile and clothing enterprises.

1. Introduction

Science and technology is the first productive force for development, which can form the core competitiveness of the country and promote the high-quality development of China's manufacturing industry. The active deployment of a number of strategies such as Made in China 2025, the manufacturing power strategy and the three-product strategy for the consumer goods industry, as well as the construction and improvement of a science and technology innovation system and mechanism in line with China's technological innovation and research and development activities based on the basic national conditions, all indicate that science and technology innovation occupies an increasingly important position in China's socio-economic development and is often at the heart of the country's strategic layout. The manufacturing industry, which belongs to the real economy, is an important pillar of national economic development and involves a number of technological innovation elements such as improved or breakthrough innovation in a large number of production processes, changes in production technology, new product development and the development of technological innovation activities, etc. Enhancing the technological research and development and innovation strength of manufacturing enterprises can further strengthen the foundation of China's national economic development and accelerate China's transformation from This will further strengthen the foundation of China's national economic development and accelerate the process of transformation from a "manufacturing power" to a "manufacturing power".

Therefore, this paper takes listed companies in the textile and apparel industry in China as the research object, and comprehensively and systematically studies the impact of diversified technological innovation activities in this industry on the output of corporate innovation outcomes, i.e., it examines the relationship between technological diversification and innovation performance, so as to provide relevant companies or industries with experience and framework ideas for analysis.

2. Review of the literature

The higher the degree of technological diversification, the more technical fields an enterprise involves and the wider the scope of technical knowledge it possesses [1], not all operational status indicators will affect the choice between technological diversification and specialization, which is largely influenced by the enterprise environment and organizational backup resources [2]. Different scholars have reached different conclusions on the trade-off between technological specialization and diversification. Some scholars believe that technological diversification plays a positive role in enterprise performance, while others hold opposite views.

Whether an enterprise conducts technological diversification is mainly influenced by the following factors: (1) the level of technological diversification that the enterprise itself possesses. High levels of original technology diversification will encourage enterprises to further carry out technological innovation activities in the new technology field, which will have a greater impact on innovation performance. At the same time, they are more inclined to achieve technological diversification through cross-border mergers and acquisitions. Although the level of technological diversification has a positive impact on cross-border mergers and acquisitions, it has a negative impact on the R&D investment of enterprises. When enterprises conduct cross-border mergers and acquisitions, it indicates that enterprises are more inclined to conduct technological diversification; When enterprises increase their investment in independent research and development, it indicates that they are more inclined to choose technology specialization strategies [3-4]. (2) The core technology of the enterprise. The consistency of core technologies can expand the marginal knowledge benefits of technological diversification, reduce the cost of technological diversification, increase the likelihood of success in developing new technology fields, and make enterprises more inclined to implement technological diversification [6]. At the same time, different levels of core technology capabilities have different marginal amounts of positive impact on the relationship between technological diversification and financial performance. High core

technology capabilities can weaken the adverse impact of excessive technological diversification on financial performance, and strengthen the positive impact of moderate technological diversification on corporate financial performance [7]. According to scholars' different measurement methods and selection criteria for enterprise performance, it is found that there is an inverted U-shaped relationship between technological diversification and innovation performance, and high levels of technological relevance can weaken this relationship, thereby slowing or inhibiting the improvement of enterprise innovation performance; At the same time, technological diversification provides opportunities for technological integration, but high levels of technological diversification may generate little marginal benefits because companies may lack sufficient scale to benefit from broad technological diversification[8,11]. These studies indicate that there is a turning point in the relationship between technological diversification and innovation performance, and there is a trend of increasing first and then decreasing. Therefore, when implementing technological diversification, enterprises should grasp the degree.

Another part of scholars has found a linear relationship between technological diversification and financial performance. On the one hand, research shows that technological diversification plays a positive role in promoting financial performance, and there is a positive correlation between the two, which is significantly affected by absorptive capacity and environmental volatility. Both absorptive capacity and market volatility can strengthen the positive impact of technological diversification on financial performance, the regulatory effect of technological volatility on the relationship between the two has not yet been fully verified [8-9]. On the other hand, research shows that technological diversification has a negative impact on financial performance. For instance, based on the perspective of resource-based theory [9], it is found that industry competition interaction can positively promote the relationship between the two, but due to environmental dynamics, not only negatively regulate the relationship between the two, but also have a negative regulatory effect on the positive impact of industry competition interaction, ultimately forming a negative correlation between technological diversification and enterprise performance.

In addition, some scholars have found that technological diversification is difficult to directly affect enterprise performance and the relationship between the two is not significant. This is mainly due to the negative and positive regulatory effects of precipitation redundant and non-precipitation redundant resources in the relationship between the two. From the perspective of scope economy and coordination cost, the two redundant resources have opposite mechanisms of action [10-12]. It can be seen that the relationship between technological diversification and enterprise performance has not yet reached a unified conclusion, For instance, Pugliese（2019）[13]based on the perspective of technology portfolio, it is found that there is a quantitative relationship between enterprise diversification and enterprise economic performance, but it is not clear what type of relationship exists between the two, which indicates that the specific form of quantitative relationship between the two is difficult to determine and is affected by many factors.

3. Model construction

3.1. Data source

1) Selection of research objects

Based on the Industry Classification of China Securities Regulatory Commission (2012) in CSMAR Database, this article selects four sub industries: textile industry, textile and clothing industry, leather, fur, feathers and their products, footwear industry, and chemical fiber manufacturing industry as the sample selection range for listed companies in the textile and clothing industry. This article excludes companies with ST and PT, excludes data entries from years with excessive missing values, and excludes companies that have been listed for less than three years. It takes 95 listed companies in the textile and clothing industry in Shanghai and Shenzhen A-share markets from 2005 to 2019 as the research object, with a total of 984 sample observation points.

2) Treatment of missing values

Delete the current data entry when there are missing values in the first and last year scores of the sample enterprise; When there is a missing value in the middle of a continuous variable, the arithmetic mean of the data at both ends is used for interpolation; When a missing value occurs for a binary variable, if the values in previous years are the same, the current value will be used. If they are different and difficult to determine, the current data entry will be deleted.

3) Data source

The data on innovation performance and technological diversification indicators in this article are sourced from the national key industry patent information service platform and manually collated by the author; The data of product diversification indicators are derived from relevant data extracted from the annual reports of listed companies obtained by the financial sector, Shenzhen Stock Exchange, Securities Star, and Oriental Fortune Choice financial terminals, and manually collated by the author; The data of internationalization indicators are sourced from Wind database and supplemented and checked according to the annual reports of listed companies. The data of control variables are all sourced from CSMAR database.

3.2. Variable selection and measurement

1) Explained variable.

The explained variable in this article is innovation performance. Based on the analysis of innovation performance measurement methods in Chapter 2, it is found that scholars use absolute values such as the number of corporate patents, the number of corporate patent applications, and the number of invention patent applications to measure innovation performance. Therefore, this study uses the number of enterprise patent applications to measure enterprise innovation performance based on the comparability of research and the availability of data.

2) Explanatory variable

The explanatory variable of this article is technological diversification. Based on the analysis of the measurement methods of technology diversification in Chapter 2, it is found that the measurement methods of technology diversification can be mainly divided into three methods: entropy method, Hufendar index method, and the number of technological fields distributed. In order to reflect the weight relationship between the number of different technological fields [14], therefore, this article selects the entropy method to measure technological diversification.

3) Control variables

By drawing on the thinking of some academics [11,15-18], This paper selects virtual variables such as enterprise size, enterprise nature, enterprise age, equity balance, intangible asset ratio, industry profit margin, and industry and year as the control variables for this study. In addition, since the measurement methods of control variables have basically formed a fixed pattern, there is no need to elaborate on them too much.

Table 1. Variable Description

target	character	Variable definitions and measures
interpreted variable	innov_perform	number of corporate patent applications in year t
explanatory variables	retech_div	entropy method
control variables	size	natural logarithm of total assets at the end of year t
	nature	a value of 1 for state-owned enterprises and 0 for non-state-owned enterprises
	age	difference between year t minus time of business establishment
	equity	sum of the shareholdings of the second to tenth largest shareholders
	dar	total liabilities at the end of year t / Total assets at the end of year t
	iar	net intangible assets in year t/total assets in year t
	roaa_zt	annual industry median corporate ROA
	industries	industry dummy variables
	year	year dummy variables

4. Empirical model construction

This paper attempts to investigate the relationship between technological diversification and innovation performance of listed companies in the textile and apparel industry, based on which the following econometric model is constructed.

1) Modeling the relationship between technological diversity and innovation performance

This paper examines the relationship between technological diversity and innovation performance from a holistic perspective and a sub-type perspective respectively. Therefore, a model of the relationship between the degree of technological diversification and innovation performance is constructed based on the holistic perspective (e.g. Equation 4-1).

$$Innov_perform=\alpha+\beta1\times detech_divit+\beta2\times Controlit+\mu it+\varepsilon it$$

5. Empirical analysis

As shown in Table 2, there is a significant positive relationship between related technology diversification and innovation performance before and after controlling for industry and year, and the R2 is optimized, enhancing the explanatory power of the model, which indicates that an increase in related technology diversification can promote the innovation performance of enterprises. The regression results of the grouped samples reveal that the positive relationship between related technology diversification and innovation performance does not differ depending on the location of the firm in different regions, its affiliation with different industries, size and nature, and remains consistent with the overall model.

Table 2. Relationship between diversity of related technologies and innovation performance

	Model	By Industry			
	Innov-perform	1	2	3	4
Retech-div	0.380***	0.290***	0.474***	0.459***	0.309***
	(0.030)	(0.050)	(0.056)	(0.167)	(0.030)
lnsize	0.048	0.115	0.029	0.174	-0.031
	(0.050)	(0.120)	(0.128)	(0.978)	(0.037)
nature	0.367**	0.414	0.402	-3.069	0.504***
	(0.157)	(0.342)	(0.296)	(2.528)	(0.120)
age	0.184***	0.174**	0.307**	-0.471	0.186***
	(0.051)	(0.087)	(0.124)	(0.583)	(0.045)
equity	0.002	0.027	-0.001	0.375	-0.069*
	(0.042)	(0.081)	(0.074)	(0.466)	(0.035)
dar	-0.089***	-0.143	-0.051	-0.153	0.077
	(0.033)	(0.115)	(0.044)	(0.622)	(0.060)
iar	0.134***	0.242***	0.075	0.593	0.136***
	(0.041)	(0.089)	(0.068)	(0.419)	(0.042)
roaa_zt	-0.029	0.074	0.063	-0.400*	-0.013
	(0.027)	(0.080)	(0.081)	(0.202)	(0.016)
Constant	-0.095**	-0.038	-0.023	0.391	-0.458***
	(0.046)	(0.095)	(0.077)	(0.346)	(0.067)
Industry control	NO	NO	NO	NO	NO
Year control	NO	NO	NO	NO	NO
R^2	0.229	0.204	0.348	0.212	0.508

Note: Sub-region [1 = Eastern region; 2 = Central region]; Sub-industry [1 = Textile industry; 2 = Textile clothing and apparel industry; 3 = Leather, fur, feather and feather products and footwear industry; 4 = Chemical fibre manufacturing].

6. Conclusions and recommendations

This paper studied the relationship between technological diversification and innovation performance of enterprises based on the reconciliation perspective of product diversification and internationalization strategy, using panel data of A-share textile and apparel listed companies in Shanghai and Shenzhen from 2005 to 2019, and came to the following conclusions: technological diversification and innovation performance are positively correlated, and technological diversification can promote the improvement of innovation performance of enterprises in the textile and apparel industry.

China's textile and garment industry listed companies are now in the situation of overproduction of products and low utilization of production capacity, which indicates that China's production and processing manufacturing technology has been counted into the world's forefront, able to use less equipment input, output more products, to achieve economies of scale, but China's textile and garment enterprises in the design of often follow the trend of foreign, rarely have their own design products, and for the basic products also Failure to carry out its product performance or new materials and other invention and innovation activities, resulting in a large number of human, financial, material and equipment and

other resources redundant, so to enhance independent innovation thinking and R & D capabilities for China's textile and apparel enterprises is crucial. The state should strengthen its financial and policy support for enterprises carrying out innovation activities, so that enterprises in the textile and clothing industry have sufficient funds to carry out technological innovation activities and explore new technological fields, achieve breakthroughs from scratch or enter new research and development fields, make full use of the internal and public technical knowledge resources of the enterprises, and promote the formation of core competitive advantages in a single technological field, or even the formation of multi-core technological competitive advantages. This will enable the company to develop a core competitive advantage in a single technology area or even a multi-core technology advantage, enabling it to gradually achieve technological catch-up and leadership in the industry and in the global textile industry chain.

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